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AUTHOR	Mueller, Daniel J.
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ABSTRACT

Educational institutions have at least two major functions: education and certification of competency. This paper examines the educational strengths and limitations of the mastery learning instruction model with respect to fulfilling these functions. The components of the mastery model are contrasted with components of other instructional models, and their relative advantages and disadvantages discussed in the nine sections of the paper. Components of the mastery model are identified as: (1) formal specification of a comprehensive set of cognitive objectives; (2) instruction; (3) frequent formative diagnostic evaluation; (4) corrective or remedial instruction measures to remedy learning deficiencies identified in formative evaluation; and (5) criterion referenced summative evaluation. The advantage of mastery instruction is primarily its effectiveness for teaching basic skills and knowledge to slow learners and students who have not learned how to learn. Consequently, its optimal usefulness is in the elementary grades, especially primary grades. The model reduces competition among students and reduces student failure and frustration. It is also effective with disadvantaged students and slow learners at all educational levels. The model does not do well when implemented in traditionally organized schools with time-fixed instructional units. It does not maximize learning for all students. However, the inclusion of an idea of mastery speed along with mastery certification would make mastery grades useful for educational and vocational decision-making. (DMT)

Division of Teacher Education

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MASTERY LEARNING:

PARTLY BOON, PARTLY BOONDOGGLE

DANIEL J. MUELLER

division of teacher education
321 education building
indiana university
bloomington, indiana 47401

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Educational institutions have at least two major functions: education and certification of competency. Comprehensive instructional models, consequently, must include components dealing both with instruction and student evaluation. The purpose of this paper is to examine educational strengths and limitations of the mastery learning instructional model with respect to fulfilling these functions.

In the process of this analysis, components of the mastery model will be contrasted with components of other instructional models, and their relative advantages and disadvantages will be discussed. This approach is [illegible] it presupposes the existence of a catalogue of [illegible] with their respective components formally [illegible]e. Existing instructional models, to the [illegible]ed at all, tend to overlap in their in[illegible]tructional and evaluative components. [illegible]sus among proponents of the various [illegible] re appropriate to say that this paper [illegible] of mastery models, contrast them with [illegible] real [illegible]lternative models, and discuss their respective [illegible]engths.

In order to facilitate such comparison and discussion, the components of the mastery model will first be delimited. The following components enjoy a high degree of consensus among the major proponents of mastery learning (especially Bloom, 1968, 1973, 1974; Block, 1971, 1973; and Carroll, 1963, 1971):

1. Formal specification of a comprehensive set of cognitive objectives.
2. Instruction.
3. Frequent formative/diagnostic evaluation.
4. Corrective or remedial instruction measures to remedy learning deficiencies identified in formative evaluation.
5. Criterion referenced summative evaluation.

In addition to these basic components, more sophisticated applications of the model include a pretesting prior to the onset of instruction to identify learning deficiencies, which are then remediated. Other applications of the model include more tightly prescribed remediation measures following formative evaluation. Specific deficiencies are referenced to specific remedial instructional treatments, often in modes alternative to the original instructional mode.

The elements of the mastery learning model are not new. Entry behavior, individualized instruction, reinforcement, diagnosis, specification of instructional objectives, remediation, feedback, "absolute" or criterion referenced evaluation, and alternative instructional modes are concepts which have enjoyed varying degrees of popularity among instructional specialists throughout the history of formalized education. In fact, two separate instructional models very similar to the mastery learning model were conceptualized and implemented some 50 years ago (Washburne, 1922; Morrison, 1926). As Bloom concedes, "In education, the wheel is constantly being rediscovered" (1973, p. 53). This observation, however, is by no means an indictment. If mastery learning theorists

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DANIEL J. MUELLER is *associate professor of education*, Indiana University, Bloomington, Indiana.

have put together a coherent package of instructional elements which improves the quality of instruction, and maximizes the students' ability to understand and profit from such instruction and their opportunity to learn, and consequently increases student achievement, they are to be praised and encouraged in their efforts.

THE BURDEN OF RESPONSIBILITY FOR STUDENT LEARNING

Block correctly observes that the mastery learning model "shifts the burden of primary responsibility for student performance from the student to the school" (1971, p. 64). This raises a philosophic issue: to what extent should the responsibility for student learning lie with the school and to what extent should it lie with the student? The answer is that both should have some responsibility - the proportional distribution being a function of such variables as level of student advancement and ability, and level of instructional objectives. An instructional model at the opposite end from the mastery model on this continuum would place maximum responsibility for learning on the student. The instructor would communicate to students the criterion behaviors expected of them, possibly by some prescribed date, and the students would simply be expected to learn and perform. An instructional treatment may or may not be included. While the extreme case of this model may not even qualify as an "instructional" model, variants of this model, with the instructor providing some instruction or at least some guidance toward criterion behavior, are viewed as legitimate in a variety of instructional situations. Some graduate level seminars, as well as graduate and undergraduate "individual study" courses legitimately place the major responsibility for learning on the student. Nor is it difficult to conceive of instructional situations at the high school level and even the elementary school level where a major portion of the responsibility for student learning should be placed on the student.

It is, doubtless, appropriate that in the early years of formal schooling, and with students of low aptitude, and with students who for one reason or another have not "learned to learn," the bulk of responsibility for student learning should be placed on the school. Even at the college level, in most instructional situations the school should probably shoulder a substantial proportion of the responsibility for student learning. Indeed, poor quality instruction is too often excused on the grounds that it is up to the students to learn. The point is that in any instructional situation, with any students, at any educational level, there exists some optimal division of responsibility for student learning between school and students. While at the elementary (and perhaps also the secondary) level it seems likely that in many instructional situations a large portion of this responsibility should lie with school, it is clearly not the case that for most or all formal education the burden of primary responsibility for student performance should be shifted from the student to the school.

LEARNING TO LEARN AND LEARNING TO LEARN INDEPENDENTLY

The rationalization of poor quality instruction also applies to students. Students often rationalize poor learning by abdicating any responsibility for their own learning. After several years of teaching graduate students, I continue to be amazed and frustrated at the inability and unwillingness of many of them, including some doctoral students, to take responsibility for their own

learning. They simply haven't learned to initiate and direct their own learning. I can only conclude that these students are products of an educational system (kindergarten through college) which directs and monitors the learning process so closely that they do not develop the ability or desire to learn independently of that system.

Bloom (1973, 1974) reports that students taught under the mastery model learn to learn. That is, each subsequent "learning task" is mastered in less time than the previous task. This decrease in learning time is especially prominent in slow learners - those who required the most time for mastery of initial learning tasks. Bloom attributes this reduction in necessary learning time to higher motivation, reduced procrastination, and a larger proportion of study time spent "on task" - i.e., learning to learn. While this is, indeed, a very fine recommendation for the mastery learning model, the question remains, does the mastery instructional model encourage or facilitate learning to learn *independently?* By placing the major responsibility for student learning on the school, and by closely directing and monitoring the student learning process, extensive use of the mastery learning model may in fact engender a high degree of *dependence* on a formalized educational system rather than training students to learn independently.

FIXED TIME UNITS, FIXED PERFORMANCE STANDARDS, VARIABLE LEARNING SPEED: A BAD FIT

In a previous paper (Mueller, 1973), the writer emphasized that the mastery model can best be used in a school structure with non-fixed-time instructional units. In traditionally organized schools, where learning is divided into grade levels and semesters, and where students are advanced together through these fixed-time instructional units, the mastery model cannot be used to maximize learning for all students. Since students learn at different rates, it is not legitimate for an instructor to expect all students to achieve the same level of performance (mastery) over the same amount of material in the same amount of time. The writer further indicated that the mastery model *may* be implemented successfully in a conventional school setting, but only under two conditions. One condition is when the instructional objectives are very low in difficulty level. If all students are expected to master all materials during the same time period, the objectives for the entire class must be based on the ability of the slowest learning students. Such classes are of little challenge (and often a waste of time) for even average ability class members, let alone the fastest learners. The other condition under which mastery learning can be executed in a conventional school setting is when the fixed-time instructional structure is severely liberalized. Students must be allowed to pass to subsequent grades and courses at any time during the school year or semester, and the option of repeating grades and courses must be heavily utilized. Furthermore, a grade of "incomplete" must be allowed to become the rule rather than an exception, and evaluation must occur at different times for different students. In addition, some students must be allowed to carry lighter course loads than others. In short, the mastery model can be utilized in a conventional, fixed-time instructional setting only to the extent that the conventional setting can be made unconventional by eliminating the fixed-time units.

Since that time, it has become clear that mastery *is* being used in traditionally structured (fixed-time unit) schools and, according to most published reports, being used quite successfully (unsuccessful applications tend not to get published). Literally scores of papers, articles, and monographs have

reported that students have learned better under the mastery model than under alternative instructional models. What is the explanation?

In part, the explanation is that the mastery model *is* working better. The mastery model systematizes a series of instructional components which together constitute high quality instruction. Furthermore, teachers who enthusiastically embrace this model are more highly motivated and work harder than are teachers utilizing some alternative instructional models. The same is true for many students working under the model, with the consequence that students learn well under this model - the most dramatic increase in student performance occurring among the slower learning students.

My concern here, however, is not with what the model does well, but with what it does not do well, and that is to *maximize learning for all students*. A major component of the model is to pre-specify a finite set of learning objectives *for all* students; all students are to be brought up to the same level of achievement. But some students learn much faster than others. The solution of mastery practitioners is to have the slower learning students spend more time studying than do the faster learning students, until all reach the pre-specified performance level. And herein lies the rub. Presumably, faster learning students have approximately as many hours in their days as do slower learning students, and consequently should have, on the average, as much time to allocate to studying as do slower learning students. Under the mastery model the students who attain the pre-specified instructional objectives first must, in a sense, "wait around" for their slower learning classmates.

My indictment is not that the high level of performance of slower learning students on the pre-specified instructional objectives is being purchased at the expense of the performance of faster learning students on the pre-specified objectives. In fact, mastery proponents and researchers have strongly emphasized that under mastery learning both slow and fast learning students are brought to a high level of performance on *the pre-specified objectives*. My indictment is rather that the faster learning students could be learning more. If faster learning students could be motivated to spend as much time studying as are slower learning students, they could learn more than the pre-specified objectives; in some cases two or three or four times more. By pre-specifying a finite number of learning objectives and concentrating instructional efforts on bringing all students to this level, not only does the mastery model not facilitate the maximization of learning for faster learning students, it actually precludes it.

ALLOCATION OF INSTRUCTIONAL RESOURCES

If all students are to be brought up to the same level of performance, not only do slower learning students have to study more than faster learning students, but a major proportion of instructional resources must be committed to the instruction of these students. Most of the corrective and remedial efforts in mastery learning are for the benefit of the slower learning students. Block (1973) emphasizes that these correctives need not be a drain on classroom time. Many remediation procedures can be executed outside of the classroom and without the teacher (i.e. teacher aid tutoring, peer tutoring, alternative textual materials, workbook type exercises, programmed materials, and audio-visual materials). Nonetheless, these are instructional resources, which in most school systems constitute a finite resource. Furthermore, teacher time is

often involved in developing and coordinating the use of these instructional correctives. Clearly the mastery model requires the commitment of a disproportionately large amount of instructional resources to the instruction of slower learning students.

This is not a serious criticism. Slow learning students need more instruction and the commitment of more instructional facilities than do fast learning students. In fact, I have heard the opinion expressed more than once by professional educators that the best thing schools can do for fast learning students is to "get out of their way." While there is some truth in this maxim, it is somewhat of an overstatement. In addition to "getting out of their way," the schools have the responsibility to supply faster learning students with the materials, facilities, and encouragement to maximize their learning. The mastery model does not do so.

BASIC SKILLS AND KNOWLEDGE VS. LEARNING BEYOND BASIC SKILLS AND KNOWLEDGE

Without a doubt, the most curious assumption made in the mastery model is that everything (or almost everything) taught in an instructional unit must be learned in its entirety by all students (or almost all students). Or, to put it another way, any instructional objectives which do not apply to all students, or for which the expectation is not 100 percent (or 90 or 80 percent) learning, are not viable objectives. Or, to put it still another way, a teacher in a given instructional unit must have the same instructional objectives for all students. At best, this seems like a somewhat arbitrary requirement.

There are times when the 90 percent or 100 percent learning requirement is appropriate. In courses or grades where students are taught basic skills and knowledges which are critical to subsequent learning and/or to life success, the mastery requirement is sensible. But many objectives in many instructional units are not critical to subsequent learning or to life success.

In the elementary grades, especially the primary grades, a substantial proportion of instructional objectives *do* cover basic skills which, it could be argued, are more or less critical to life success. But even in the elementary grades it is to be hoped that most teachers will teach much beyond basic skills and knowledges. As grade level increases, so probably should the proportion of instructional objectives beyond basic skills. At the college level differentiating between instructional objectives which constitute "basic skills" and those "beyond basic skills" seems almost arbitrary in many or most courses.

The mastery requirement is also appropriate in areas where learnings are hierarchical, that is, where each subsequent unit builds upon previous units. Examples of learning areas where units are largely hierarchical are mathematics, English, and foreign languages. But in much school learning a hierarchical sequencing either does not apply, or applies only to a small degree. A third grade social studies unit on Indians is not a prerequisite for a unit on transportation. American history is not a prerequisite for world history, or vice versa. And physical education 1 is not an essential prerequisite for physical education 2. Even in the area of mathematics, complete mastery in one course is not typically required for understanding the concepts and principles of another course. It is doubtful, for instance, that mastery of 90 percent or

100 percent of the material taught in college algebra is necessary to understand trigonometry, and it is possible to learn multiplication before subtraction. Even then, those learnings which are prerequisite for subsequent instructional units are only essential for those students who are, in fact, planning to go on to the subsequent units.

At this point it should be clear that a distinction between basic skills and knowledge, and objectives which are not basic skills and knowledge is not at all clear. Perhaps it would be more judicious for teachers at all instructional levels to rank instructional objectives from most to least important. Major teaching emphasis and the major allocation of instructional resources should then be directed toward those objectives judged most important.

THE MEANING OF A GRADE OF "A"

Grading students has always been a thorn in the side of instructors and of educational institutions. Nonetheless, the schools have the responsibility to certify student competency as well as to educate. Letter grades are often used to symbolize quality of student performance, although numbers and other symbols are sometimes used. These grades, whatever form they take, serve a variety of purposes, including description, decision making, and prediction.

Mastery proponents, especially Bloom (1968), Block (1971), and Airasian (1971), recommend the use of the letter grade of A for all students who master the pre-specified objectives. There are several serious problems with this practice. One problem is with establishing criterion standards. Critics of criterion referenced grading have emphasized the difficulty of determining appropriate or "correct" criterion levels. In fact, some have suggested that setting cut-off points for mastery, or for any given criterion letter grade, without the use of normative data, is as much arbitrary as it is absolute (Ebel, 1973; Gronlund, 1973; Mueller, 1974).

Block (1973) and Bloom (1973) have suggested the indirect use of normative standards in establishing the mastery standard for A level performance: that level of performance which had been designated as A performance before mastery instruction was initiated. In practice, this would mean using the same tests, or at least some of the same test items, in mastery summative evaluation as had been used in previous (pre-mastery) years or semesters. If all or nearly all students can be brought up to this performance level, mastery proponents reason they should all receive a grade of A. On the face of it, this procedure for establishing mastery criteria and for assigning grades appears highly reasonable. A closer look, however, reveals some problems.

In many instructional models it is assumed that more can be taught than can reasonably be tested in any particular instructional unit. Tests are constructed by randomly or systematically selecting items from a large content domain of all material taught in the instructional unit. Students' grades, then, represent not only their level of performance on test items, but also the level of performance in the larger domain. Students demonstrating a high level of performance on such tests, and consequently receiving a grade of A, are assumed to have achieved a high level of performance in the larger instructional domain as well. This assumption is legitimate if the tests are properly constructed; i.e., are content valid.

In criterion-referenced assessment the situation is considerably different. The instructional domain is closed or finite, and student assessment is tightly linked to instructional objectives. Students performing at a high level on criterion-referenced tests *cannot* be assumed to have learned more than is directly demonstrated by their test performance. (In non-mastery testing we would call this procedure "teaching the test" or "coaching." Under the mastery model teaching the test is not coaching, and is perfectly legitimate, since the test constitutes the entire instructional domain.) The point is that utilizing criterion levels representing A level performance on pre-mastery tests as the A level criteria for mastery tests may not be equitable, since students performing at the A level on non-criterion-referenced tests can be assumed to have learned more, in an absolute sense, than has been tested, whereas students performing at the same level on mastery tests cannot be assumed to have learned more than is directly reflected in their test performance.

Some critics would go even a step farther, arguing that since the mastery model emphasizes instruction and assessment of basic skills and knowledge (minimum essentials) only, mastery level performance would be equivalent to a lower than A level of performance in a non-mastery instructional situation (perhaps B, C, or even D - depending on the proportion of instructional objectives which constitute minimum essentials). Since the definition of "basic skills and knowledge" is so nebulous, I think the best solution is *not* to attempt to equate performance levels for mastery and non-mastery assessment. Rather, I recommend the use of a symbol or letter completely unrelated to the traditional A through F letter grades for certification of mastery level performance (perhaps M for Mastery, or P for Passing, or S for Satisfactory).

An equally serious problem is the use of mastery grades in prediction and decision making. Mastery grades are useful in deciding whether or not students are prepared to advance to subsequent instructional units - especially if the units are hierarchical. But non-mastery grades are useful in making a wide range of instructional and even vocational decisions. Elementary schools, as well as high schools and colleges, depend heavily on students' grades for placing students into remedial and advanced instructional programs. Non-mastery high school grades are useful to students, parents, and guidance counselors in deciding which students should enter college preparatory programs and which should not. High school and college grades are useful to students, parents, and guidance counselors in deciding which college or graduate school a student should enter, and to college admissions officers (both undergraduate and graduate) in deciding which students to admit. Further, some employers find non-mastery grades helpful in making hiring decisions.

Were I the owner of an automobile repair service examining credentials of recent graduates of an auto repair training program I would not be satisfied to know that all graduates had *eventually* achieved criterion performance in basic skills. I would want to know which graduates were the best mechanics, or at least, which had attained mastery of basic skills the quickest. In short, because mastery grades are specifically designed not to discriminate, they are of no use in making discriminatory decisions. (This is not to imply that non-mastery grades are excellent predictors - either academic or vocational. Typically they are fair to poor predictors; but mastery grades are no predictors at all.)

COOPERATION VS. COMPETITION

Bloom (1973) reports that there is growing evidence that students learning under the mastery model "develop cooperation in their learning as contrasted with competition" (p. 55). Social-psychological research literature clearly documents the extent of the competitive value in Western societies - especially in the United States. Adult subjects in laboratory experiments are often found to compete rather than cooperate even when cooperation would result in absolute gains or rewards whereas competition results in smaller absolute gains or even losses. These subjects apparently care more about "beating the other guy" than they care about absolute gains or losses. Cross-cultural studies have further shown that American school children demonstrate considerably higher competitive tendencies than do school children from other cultures. Economic and political conservatives would argue that this is a positive phenomenon - a high emphasis on competition is one of the values which has "made this country a great nation." And at one level they are, of course, correct But it is the winners of this competition who benefit the most. When individuals or groups compete for limited rewards there are necessarily also losers. Research has also shown repeated failure to be severely debilitating, psychologically. In schools, if students are constantly required to compete for limited rewards (i.e., high grades), the slower learners will consistently be the losers, and will quickly lose interest in further learning. If mastery learning reduces competition - and it probably does - this is a plus for the model.

But we can't have our cake and eat it too. The prospect of winning can be a tremendously valuable motivator. If competition were completely eliminated from schools, and if schools were to distribute rewards (high grades) equally across all students, the motivation to try harder would also be largely eliminated. Further, upon graduation, these students would be in for an abrupt awakening. They would discover that in the real world rewards are not equally distributed - they go primarily to the winners.

The solutions to this dilemma are three-fold. On the one hand, schools must manipulate contingencies such that some students are not consistently losers. Secondly, schools can manipulate contingencies such that the amount of difference between winners and losers is reduced. (A loser who doesn't lose by much will more readily continue to try than a loser who finds himself out of his league entirely.) Operationalizing these solutions means proper student placement (so that students are competing with other students close to their own performance level) and major allocation of instructional resources to the slower learners, as was suggested above.

The third solution is to de-emphasize competition by de-emphasizing grades. This solution is a little tricky to operationalize. If schools de-emphasize grades too much, or eliminate them altogether, they abdicate their responsibility to certify quality of student performance. However, emphasis on grades in our schools is presently so intense, at all grade levels, that schools could afford to reduce this emphasis considerably without severely endangering fulfillment of their certification responsibility. In the elementary grades, and especially in the primary grades, where major life decisions are not being made for or about students, the competitive grading emphasis could be almost entirely replaced by assessment for description and diagnostic purposes only.

MOTIVATING STUDENTS AND TEACHERS TO WORK HARDER

Block (1973) and Bloom (1973) report some initial evidence that the mastery model is indeed motivating students to study harder. Mastery learning, it is reported, generates "high levels of positive student interest and attitudes toward the topics learned" (Block, 1973, p. 39). The evidence at this point is in the form of very "soft" data (e.g., students learning under mastery *report* that they enjoy learning, like the subject matter being taught, and possess a positive attitude toward future learning). Nonetheless, it is believable that mastery learning does have more positive affective effects on students than do some other instructional models - one reason being that failure is reduced under this model.

Another possible reason for higher levels of student interest and more positive student attitude resultant from mastery instruction is that teachers work harder under the mastery model than under some alternate models. Implementing mastery instruction requires more attention to individual students and more teacher preparation than do many other instructional models. Any instructional model which can motivate teachers to put more time and energy into their teaching is bound to pay off in more positive student reactions to the teaching-learning process. Further, teachers who are highly committed to good teaching often display a high degree of enthusiasm for their subject matter and for the teaching-learning process. Teacher effectiveness research indicates that teacher enchusiasm is one of the most consistently effective teacher behaviors in generating high interest and positive attitudes (and often high achievement levels) in students. If the mastery model can motivate teachers to work harder and to be more enthusiastic in their teaching, this is to its credit. It should be noted, however, that higher degrees of teacher commitment and enthusiasm are not necessarily direct functions of the use of the mastery model. Harder working, more enthusiastic teachers using any instructional model would probably induce more positive student affect and higher student achievement than would uncommitted, unenthusiastic teachers using the same model.

CONCLUSIONS AND A RECOMMENDED EXTENSION OF THE MASTERY MODEL

As we have seen, the mastery learning model has some educational advantages when compared with other instructional models. It is apparently quite effective in teaching basic skills and knowledge - especially to slow learners and students who have not learned to learn independently. Consequently, its optimal usefulness is in the elementary grades, especially the primary grades, and in other instructional situations where basic skills constitute a major portion of total instructional objectives (e.g., in teacher training methods courses at the college level). Since the model reduces competition among students and reduces student failure and the frustration which accompanies repeated failure, mastery learning is also an effective model to use with educationally disadvantaged students and slow learners at all educational levels, who would typically be perpetual losers in competitive instructional/evaluative models.

What the model does not do well, especially when implemented in a traditionally organized school structure with fixed-time instructional units, is maximize learning for all students. Since the entire instructional emphasis is on a finite set of instructional objectives (those constituting basic skills

and knowledge), a learning ceiling is established beyond which the faster learners are not allowed to progress. Consequently, the mastery model has limited usefulness in the upper grades, especially at the college and graduate levels, and in any instructional units (even in the elementary grades) where basic skills and knowledge do not (or should not) constitute a major portion of the total instructional objectives. Further, the mastery model is not useful in training students to learn independently. And finally, grades resultant from mastery learning have minimal usefulness in decision making and prediction.

One addition to the mastery model which would make mastery grades useful for educational and vocational decision making and prediction would be to include an index of *speed of mastery* along with certification of mastery in a particular instructional unit. The mastery model equates *eventual* mastery with high quality performance. In measuring educational achievement, two variables must be considered: the amount a student learns, and the time required for him to learn it. For most uses of student grades it is important that both variables be reported.

Another extension to the mastery model, which would eliminate the ceiling on learning for the faster learners, would be to divide learning objectives for each instructional unit into two categories: basic skills and knowledge which are considered essential for all students to achieve (minimum essentials), and those beyond minimum essentials (see Gronlund, 1973). All students would be expected to master the basic skills and knowledge which are essential to life success or to subsequent learning. Students who had mastered these minimum essentials would be encouraged to continue on to the "developmental" or enrichment" objectives. The proportion of learning objectives in the two categories would vary considerably across instructional units and grade levels. All students who attain mastery of minimum essentials would be certified as having done so. Those who advanced to the developmental objectives would receive grades (either norm-referenced or criteria-referenced) indicating the extent of this progress.

If separating instructional objectives into two categories, "essentials" and "beyond essentials," seems somewhat arbitrary, a more realistic arrangement may be to classify objectives into three, four or more criterion categories. These categories would range from most to least important, with the first category, constituting the most basic skills and knowledge, to be mastered by all students, and receiving the bulk of instructional emphasis. The remaining categories would be graduated in difficulty level and/or instructional importance.

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